Investigating Waves II - Pump-Up the Volume!

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Course Name: 8th Grade Integrated Science

Standard Fulfilled: Standard IV: Students will understand the relationship among energy, force, and motion.

Objective Fulfilled: Objective 1: Investigate the transfer of energy through various materials.

Intended Learning Outcomes Fulfilled:

- 1a. Observe objects and events for patterns and record both qualitative and quantitative information
- 1e. When given a problem, plan and conduct an experiment using a scientific method
- 4a. Provide relevant data to support inferences and conclusions

Time Needed: Two 45 minute class periods

Inquiry: Part A: How does changing the amount of energy affect sound waves? (Structured Inquiry)

Part B: What factors influence the pitch of a sound wave? (Guided Inquiry)

Prior Knowledge Needed: Investigating Waves I – Surfin' Stones should be conducted prior to this activity

Introduction:

These activities further explore the characteristics of waves, especially the volume and pitch of sound waves. Students will be designing their own investigations to answer teacher-constructed questions.

Materials Needed for each Team of 2-3 Students:

Part A: Golf balls – 1 per group

Meter stick

Scale - available if students desire to measure the mass of their object

Part B: Rigid plastic ruler

Materials Needed for Teacher Demonstration:

Part A: One junk drawer object Part B: Rigid plastic ruler

Procedures:

Part A:

- 1. Introduce the topic (maybe have the tag-line from the song "Pump Up the Volume" playing). Demonstrate the dropping of an object onto the teacher's desk.
- 2. Divide the students into groups of 2 or 3
- 3. Distribute instruction sheet to each group
- 4. Allow one member of the group to gather worksheets and golf balls.
- 5. Allow students to design and conduct an experiment to answer the question on the worksheet: How does changing the amount of energy affect sound waves?
- 6. As groups finish with their investigations, have them complete the worksheet and discuss their findings. Using a "round robin", have student groups present their conclusions to the class. As a class, discuss the merits (validity) of these conclusions do the data collected support them?
- 7. Come to a class consensus that amplitude is the measurement of the energy that a wave is carrying, or its volume when talking about sound waves. This is a time to use formative assessment techniques to ensure that consensus is reached.

Part B:

- 1. Demonstrate how to "strum" a rigid plastic ruler that hangs out over the end of a table. Also discuss what the pitch of sound is (do not relate pitch to frequency at this point). Perhaps a couple of musically inclined students in the classroom can give an example of high pitch and low pitch.
- 2. Divide the students into groups of 2 or 3
- 3. Allow students to design and conduct an experiment to answer the question on the worksheet: What factors influence the pitch of a sound wave?
- 4. As groups finish with their investigations, have them complete the worksheet and discuss their findings. Using a "round robin", have student groups present their conclusions to the class. As a class, discuss the merits (validity) of these conclusions do the data collected support them?
- 5. Come to a class consensus that the number of vibrations per second that a wave is carrying (frequency) is what affects the pitch when talking about sound waves. The higher the frequency, the higher the pitch. Students should also notice that the shorter the part of the ruler that is vibrating, the higher the frequency. This is a time to use formative assessment techniques to ensure that consensus is reached.

Student Instructions – Do Not Write on This Sheet

Investigating Waves II - Pump-Up the Volume!

O.K., you have just scientifically proven that dropping bigger objects into water creates bigger waves. But if you don't happen to surf every day, does this new found knowledge really have any bearing on your life? We're about to go beyond cool surfboards and tsunamis to everyday stuff.

Here's What to Do:

- A- Form a group of 2 or 3 people.
- B- Get a question sheet for your group
- C- Go gather one golf ball and a meter stick
- D- Design your own mini-experiment to answer the following question: How does changing the amount of energy affect sound waves?
- E- Get going with your experiment, but first, here are some things to remember:

Remember to record data on your data table for each test.

Remember to conduct several trials for each test (sometimes screwy things can happen, so repeat, repeat, repeat to make sure your result isn't just one of those screwy things.)

Remember to test only one thing at a time, and keep all of the other variables constant.

Remember to label your data chart.

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Pump-Up the Volume! Part A

Student Names		
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Observe a demonstration of your teacher dropping an object onto the desktop. Keeping the results of your stone surfin' experiments in mind – how can you change the amount of energy put into a wave?

Question: How does changing the amount of energy affect sound waves?		
Prediction:		
Describe how your group will test this		
What one variable will you change? (Independent Variable)		
What kind of variables will you "measure"? (Dependent Variables)		
Can you "measure" with your body or senses, or do you need an instrument?		
What things will you keep the same for all trials?		

Data Table

Object Dropped		
A		
Α		
Α		
Α		
Α		
Α		
Α		
Α		
Α		

Observations

Conclusion:

- 1. How does changing the energy used to make a sound wave affect it? Use your collected data to support your conclusion.
- 2. What characteristic of a sound wave is affected by changing the amplitude of that wave? Use data from the Surfin' Stones experiment and this one to justify your answer.
- 3. Are your results qualitative or quantitative?

Just Add Energy - Part B

Student Names
Question: What factors influence the pitch of a sound wave?
Observe a demonstration of your teacher strumming a plastic ruler. In this activity you will change variables and make observations to determine what affects the pitch of a sound wave while strumming ruler.
Procedure: Accurately describe what you did to answer the question. In other words, describe what you tested as an independent variable(s).
Observations: Accurately record what you observed. You should make a minimum of 2 observations each time you change an independent variable. In other words, what are the dependent variables that you saw?
Conclusion: Precisely describe the factors that influence the pitch of a sound wave. Give evidence from your experiments that support this.
Define frequency:
Will something that does not vibrate produce sound?